Ætea anguina—Colour, white; 12, and sometimes 13, tentacles.

Membranipora pilosa—Light brown colour; 12 tentacles.

M. pura—Very light brown in colour; 16 tentacles.

Diplopora cincta—Colour, dark brown; 13 tentacles. Observed the true mouth open and shut, apparently by means of a sphincter muscle, as mouth opened from an invisible point to a small circular area and then closed again. A very fine polyp.

Lepralia Ellerii—Bright scarlet in colour; 24 tentacles; epidermal layer thick; the spines round the mouth protruded through it, and showed clear and colourless.

Cellepora fusca (?)—16 tentacles; colour, various, from orange to dark purple and sometimes dark dull green. Under the microscope the pigment cells in that part of the animal which invests the cell are of a red or purple, or sometimes intensely black colour; rarely distinct, generally completely coalescent, and sometimes variegated with beautiful silvery streaks—a most gorgeous sight.

Retepora cellulosa—Colour, pink and rose red; 12 tentacles.

Petralia undulata—Colour, brown; ovicells with scarlet ova.

Idmonea radians—Colour, delicate French grey; 8 tentacles.

Serialaria Woodsii and *S. Australis*—Both 8 tentacles; basal tubes with granular masses scattered about.

Art. XIII.—*Electric Fire Alarms.*

By R. E. Joseph.

[Read 8th September, 1881.]

This paper is brought forward with a view of drawing attention to the assistance "electric fire alarms" afford to our fire brigade organisation. A system of fire alarms may be described as a means by which information as to the exact locality of a fire breaking out can be transmitted without delay to the fire brigade station.

Before describing any of the methods by which this can be accomplished, it will be as well to consider the necessary conditions that are required for an efficient system. It should be simple in construction; not liable to get out of order; certain in its action; be capable of transmitting its signals automatically—that is to say, it must not require any complicated instructions to be carried out by the person giving the alarm, for we must imagine that such person might be in a state of excitement, and could not, therefore, be depended upon to read or execute anything but a very simple direction.

The receiving mechanism must be reliable, and consist of audible and either a visual or recording alarm. If audible alone, the same signal must be repeated at short intervals, to ensure its correctness being verified.

There is very little doubt that America possesses the most extensive and perfect system. One of the earliest forms is still in use there, and works satisfactorily.

The city or town is divided into blocks, each known by a number; at a suitable place in each block is fixed a small wooden or iron case, having a door secured by a lock. On this door is painted the number of the block, and instructions where to obtain the key. There are three or more keys to each case, one being left at the nearest hotel, one at a chemist's or other suitable store, and one with the policeman on duty. In case of fire breaking out in any block, the person who wishes to give an alarm, after obtaining the key, opens the door of the case. Inside is to be seen a ring attached to a chain, with the simple instruction of "Pull." The ingenious part of the mechanism now comes into play. Irrespective of the chain being pulled either quickly or slowly, to its full length or only for a short distance, if it be held in the hand or let go, the signal is transmitted with the same certainty and regularity. Pulling the chain down raises a small lever with a weight on it that is instantly released; this starts a train of wheel-work which in rotating closes and breaks an electric circuit, transmitting signals something like the Morse code.

At the receiving station these signals come in the form of strokes at irregular intervals on a large bell; at the same time a Morse register is started, and the signals recorded on the tape in the ordinary way. These signals are repeated three or four times, the sending wheel being arranged for that purpose. With the exception of a somewhat expensive

apparatus at each sending box, this system appears to be very good; it is reliable, and perfectly automatic. I do not propose entering into the details of fire stations, which in some of the large cities in America contain very elaborate means of recording and communicating with other stations, and, as described by Mr. Carpenter here some time back, "placed the harness on the horses, liberated them, and dropped the firemen into their clothes and boots, and on to the seats on the engines, all being effected by electricity!"

Several systems are now under trial in England—one very similar to the American; but the transmitting signal is sent by pulling out a small knob. This winds up a spring, which, on being released, acts on a train of wheel-work as before described. Another system consists of the transmitter being composed of two small inclined metal rails, having insulated pieces inserted at irregular intervals. A metal ball or ring running down the rails forms or breaks the circuit, and thus transmits the alarm. The ball is held up by a spring, and is released by pressing a knob. Several sets of rails can be placed in the box, the ball rolling down one and then falling on to the next, and so on, thus repeating the signals to any extent required. The signals are received on a bell and Morse instrument, and the alarm is notified as having been received by the fire station ringing a bell placed in each of the sending boxes. A similar form records its signals by ringing a bell and throwing up a number in an ordinary indicator. This necessitates a pawl and ratchet arrangement, a method that does not appear reliable for quick work; for even the Wheatstone A B C instrument, one of the most perfect of its type, often gets out of adjustment.

Another form introduced in Glasgow, and known as "Bright's system," depends on balancing the resistance of the boxes, in which are placed artificial resistances. A description of this system appears in the *Telegraph Journal* of 15th February, 1880, and a plan that I now propose might be adopted here is based on its principle. I do not think it better than the American system; but it is simple, cannot get out of order, and could be constructed at very little expense. I propose first dividing Melbourne and its suburbs into, say, ten districts. These might consist of Richmond, Prahran, St. Kilda, Emerald Hill, Carlton, Collingwood, Fitzroy, Hotham, East and West Melbourne.

Each of these districts would have a station, that might be either the fire or police station, providing an attendant

always be present. These stations would be connected by the close circuit system with the central station. The station instruments would consist of a polarised relay, switch and key, telephone and transmitter, and a local battery and bell. At various places on the line, inserted in a loop, would be placed the fire alarm boxes, consisting of small iron cases having a glass door, on which would be painted, "In case of fire, break the glass."

The mechanism inside is of a simple description. A small polarised lever connects the loop-line; but which, on the glass being broken, is moved back, and then rests on a stud, and places the line to earth at that spot and through a known artificial resistance. Every box on each line would have a different resistance, increasing by 5, 10, or 15 ohms, according to the length of the line. On the signal being received at the central station a reversed current is sent through the line, which, passing through a small electro-magnet in each box, restores the lever to its original place, and at the same time shows a small disc attached to it, thus showing to the sender that the alarm has been received. In the alarm box would also be two plug-holes, by which means a telephone could be readily placed in circuit; this would prove convenient if after the brigade arrived at the fire it required extra assistance or apparatus.

The instruments at the central station consist of a relay and battery in circuit with each line; in circuit with all the relays an alarm bell and switch-board; a circular set of resistance coils, corresponding to those in the alarm boxes, and a galvanometer, the whole being arranged as a Wheatstone bridge. On the circuit being broken in any line the alarm bell will ring, whilst a number shown by the relay in action will at once indicate the particular line signalled. This line is then switched on to the resistance coils; the galvanometer needle will then be deflected; a handle attached to the line is then turned round the resistance coils until the needle returns to zero. The number corresponding to the resistance found will be the box from which the alarm is sent. The current is then switched off, and sent in a reverse direction, replacing the lever in the alarm box, as before described.

If either of the district stations be required, a reversed current sent will at once act on the polarised relay and cause the bell to ring, after which telephonic communication is established in the ordinary way. You will be able by means of this diagram to understand the whole matter better,

perhaps, than I have explained it; although it may appear complicated, those conversant with circuits will perceive that it is not so. The advantages it may possess are economy of construction, automatic action, avoidance of mechanism, and facility of communicating through the boxes to district stations on the same line. The close circuit system also possesses an advantage of giving an alarm at once should either the lines, batteries, &c., be out of order. I may state that the plan of breaking the glass in the alarm box appears to meet with favour in places where it has been tried; it avoids the delay of seeking for a key. There is little liability of false alarms being given; few people out of mischief would break the glass, as it could scarcely be done without attracting notice. The subject of fire alarms and the necessity of adopting them is engaging the attention of most places that are not already provided with a system. Organisations for the extinction of fires are either a necessity or otherwise. Few people doubt the necessity; hence the establishment of fire brigades in all parts of the world. Having, then, admitted that we require fire brigades, is it not reasonable to ask that they shall be in as perfect a state as possible for the extinction of fires?

Many years ago, before the water-supply system existed in Melbourne, water-carts were employed to bring water to a fire. Would such a course be tolerated at the present time? and why not? Simply because the present means enable the brigades to obtain a supply of water quickly and in quantity, and thus they are enabled to prevent a large amount of property being destroyed. But the early intimation of a fire to the fire station is a matter of as much importance as the water supply. I believe most authorities agree that the first few moments at the outbreak of a fire are the most important. Yet, how is such intimation given in Melbourne? Either by cab or messenger, or by the man in the look-out tower, but who cannot be aware of it until after it has actually broken through the building. As before mentioned, America possesses the most perfect system in the world. They were the first to grasp the great aid that the telegraph lines afforded them for this purpose. Fire alarms have been in use there for over twenty years. In New York alone there are nine hundred fire-alarm boxes; whilst every small town, of even five thousand inhabitants, has established a system of some kind. Other countries soon followed America's example; but it is only within the last couple of years that England saw the necessity of their use, and they are only now in an experimental stage.

In Melbourne we are still further behind. That some system or another will some day be adopted here there is very little reason to doubt, and then it will be admitted as a necessary and valuable auxiliary. If it be necessary then, it is so now, and must have been years ago, or as soon as the telegraph lines in our city provided us with a means of doing so. And it certainly does appear curious that perhaps some great calamity will force us to a plan that common sense should have caused us long ago to adopt.

The number of serious fires in Melbourne average about one hundred per annum. Much valuable property is thus destroyed; and it is not too much to say that with some efficient system by which an early intimation could be given, the amount of property destroyed would be greatly diminished.

Most of the bonded and other warehouses are closed at noon on Saturdays, and remain locked up until Monday. In such places an automatic circuit-closer should be fitted in connection with the general system. These circuit-closers consist of an arrangement that closes or breaks the circuit as soon as the temperature of the room in which it is placed reaches a certain limit. They are largely used in America, the insurance offices there reducing the premium to all stores and buildings in which they are used.

Statistics furnished from New York state, "whilst in 1866, 1867, and 1868 the percentages of total destruction of buildings were 7, 6½, and 5, in 1877, 1878, and 1879 they were but 3·45, 1·14, and 1·6 respectively, the reduction being caused by the improved system of their fire alarms." And a paper recently read at a scientific section at Brussels states that, from statistics collected, with the most perfect system of fire alarms serious fires were reduced to 4 per cent.; with telegraph communication from offices alone, but without alarms, 17 per cent.; while without any telegraph communication they reached 27 per cent. I have in this paper endeavoured, in as brief a manner as possible, to explain the general ideas and advantages of fire alarms, without entering into all the numerous and ingenious devices that have been and are continually introduced for that purpose.